

Shallow-water residency and limited dispersal of Atlantic halibut in the Gulf of Maine

Mark D. Evans¹, Andrew C. Seitz¹ and J.Kohl Kanwit²

¹ University of Alaska Fairbanks, School of Fisheries and Ocean Sciences, Fairbanks AK

² Maine Department of Marine Resources, West Boothbay Harbor ME

Introduction

- Atlantic halibut (*Hippoglossus hippoglossus*), once abundant in the Gulf of Maine (GOM), were overfished until the stock collapsed in the 1940s.
- An electronic tagging study was conducted 2007-2010 by the Maine Department of Marine Resources
- The study objective was to determine if GOM halibut migrate to spawning grounds on the Scotian Shelf and mix with Canadian halibut stocks



Figure 1: Atlantic halibut tagged with DST's (1a) and PSAT tags (1b,1c)

Methods

- Between June and July of 2007, 33 adult Atlantic halibut were tagged and released in the near-shore waters of the GOM.
- Two types of electronic tags were used...
 - 29 fish were tagged with Data Storage Tags (DST's) which log depth and temperature data at user-programmed intervals for up to one year (Fig. 1a).
 - Four fish were tagged with Pop-up Satellite Archival Transmitting (PSAT) tags. These record depth, temperature and ambient light levels, which are used to estimate geo-position (Figs. 1b,1c).
- Tags were programmed to record data at intervals that varied from every 15 mins to every 1.5 hrs.
- In this study, depth profiles were used to identify spawning activity and offshore movement. Longitude was used as a proxy for east-west movement

References Cited

- Loher, T. and A. Seitz. 2008. Characterization of active spawning season and depth for eastern Pacific halibut (*Hippoglossus stenolepis*), and evidence of probable skipped spawning. *J. Northw. Atl. Fish. Sci.*, 41: 23-36.
- Seitz, A., Norcross, B.L., Wilson, D., and J.L. Nielsen. 2005. Identifying spawning behavior in Pacific halibut, *Hippoglossus stenolepis*, using electronic tags. *Environ. Biol. Fishes* 73: 445-451

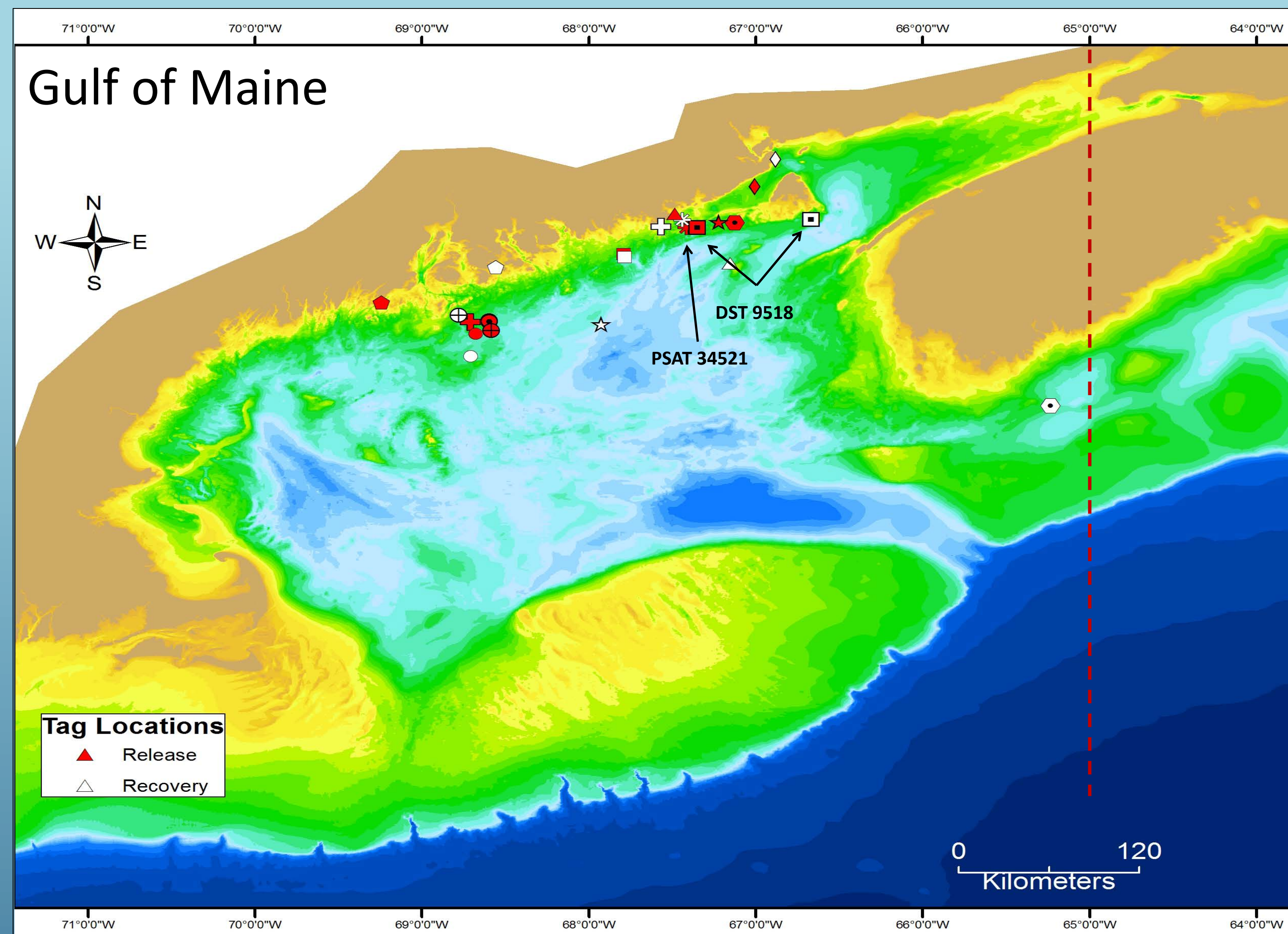


Figure 2: The Gulf of Maine, showing release and recovery locations of 12 electronic tags from which data was recovered. Each symbol identifies a different tag. Red symbols denote release locations and white symbols indicate where the fish was recovered or where the archived data were transmitted from.

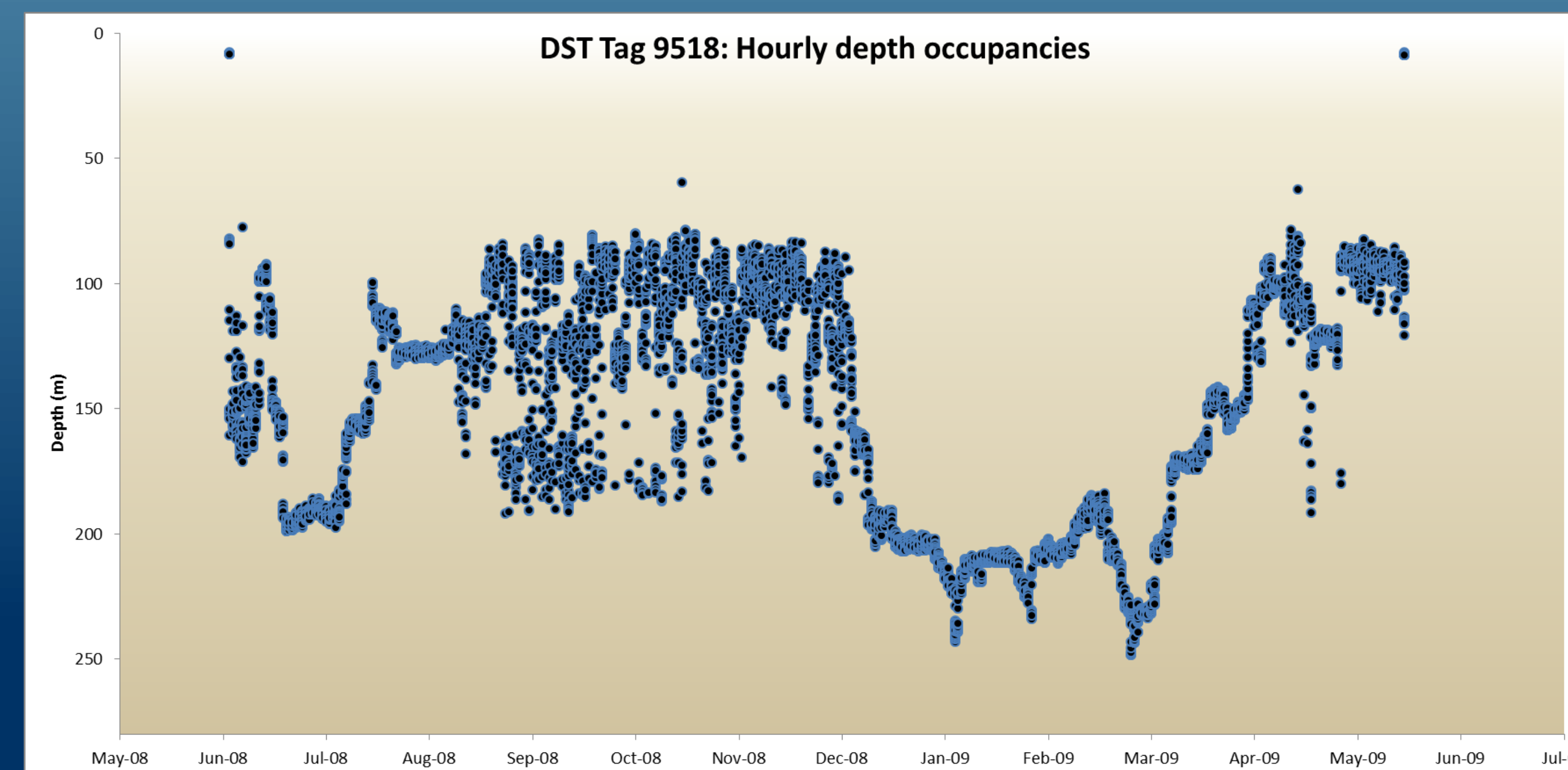


Figure 3: DST depth profile of 104 cm fish at-liberty for 353 days. Depths were recorded hourly. This fish recorded the deepest depth (248 m) of all the data retrieved. The profile shows high vertical activity Sept.- Oct., decreased vertical movements and shallow occupancy Nov.- Dec., and deep occupancy with limited vertical excursions Jan.- Mar.

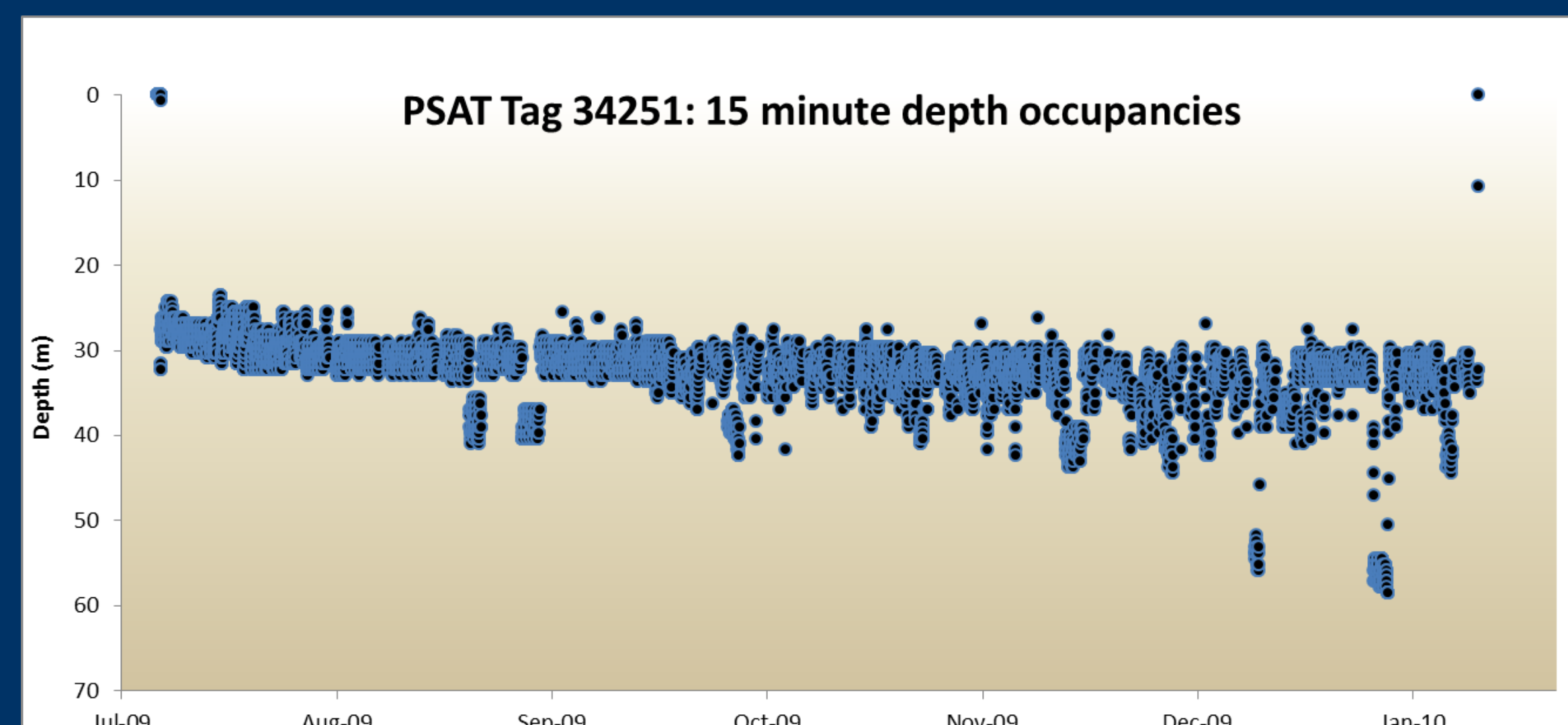


Figure 4: PSAT depth occupancy profile of 114 cm fish at-liberty for 184 days. Depths were recorded every 15 minutes. In six months, this fish never went deeper than 60 m.

Acknowledgements

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Results

- Data was retrieved from 12 tags (7 DST's and 5 PSAT tags) which were attached to fish that ranged in size from 97-148 cm.
- The data collection periods ranged from 14 days to over one year, with 6 tags recording data during the spawning season.
- Eleven fish had returned to the GOM close to their release locations, one to within 2 km. One fish was recovered outside the gulf (fig.2).
- All tags recorded depth and temperature data. No fish went deeper than 248 m (fig.3). Most of the fish spent extended periods of time above 100 m (Fig. 4).
- Position estimates were retrieved from one PSAT tag. A 5-day running average of these data suggest that the fish spent much of the summer northeast of the GOM, but returned in the fall before the start of the spawning season on the Scotian Shelf (fig.5).

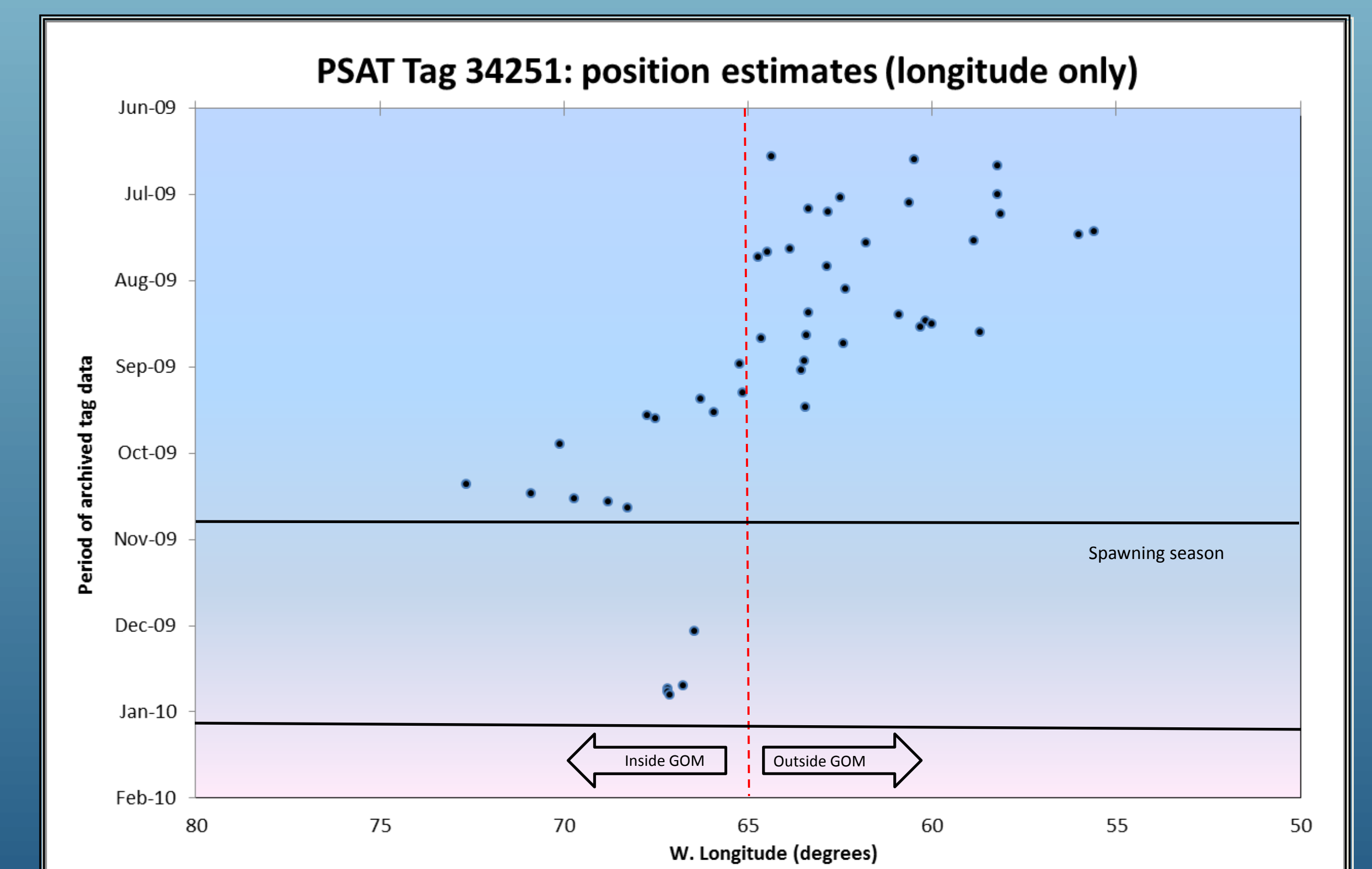


Figure 5: Longitude estimates recorded for this 114 cm fish indicate that it left the GOM early in its six months at-liberty, but during spawning season (bordered by the two horizontal solid lines), it did not venture east of 65° W. Longitude (indicated by the vertical dashed line), suggesting that it was in the Gulf or south along the coast during this time. Light-based longitude position estimates are typically coarse (+/- 100 km.).

Discussion

- Atlantic halibut in the GOM appear to occupy shallower winter depths than other large flatfish. Pacific halibut (*H. stenolepis*) migrate to offshore depths of 500-600 m prior to spawning (Seitz *et al.*, 2005). Atlantic halibut in Norwegian fjords have been found to winter as deep as 900 m (Michalsen, unpublished data).
- From the depth data, it appears that none of the fish in this study participated in the winter spawning aggregations off the Scotian Shelf, which are believed to peak from Nov. to Dec.
- It is possible that GOM halibut spawn in the northeast with other populations, but these tagged individuals did not do so at the time of this study. Atlantic halibut are assumed to spawn annually but recent studies of Pacific halibut have provided evidence of skipped spawning among mature adults (Loher and Seitz, 2008), and that could be the behavior for these fish as well.
- Alternatively, GOM halibut might spawn within the confines of the Gulf, at shallower depths and at different times than other western Atlantic halibut.
- A reproductively isolated sub-population of halibut in the GOM has implications for management policies seeking to rebuild the stock and merits further study.